OPINION PAPER

Title Page

Nutrition assessment in process-driven, personalized dietetic intervention – the importance of assessing behavioral-environmental aspects: Results of the IMPECD project

Running head: nutrition assessment and importance of behavioural aspects in dietetics

Authors:

Kathrin Kohlenberg-Müller[1], Sara Ramminger[2], Alexandra Kolm[3], Alyanne Barkmeijer[4], Christina Gast[1], Marleen Adam[5], Bente Le Bruyn[5], Renate Heine-Bröring[4], Shelly Rachman-Elbaum[2], Andrea Werkman[4], Koen Vanherle[5], Elisabeth Höld[3], Daniela Wewerka-Kreimel[3], Luzia Valentini[2]

[1]Hochschule Fulda – University of Applied Sciences, Department of Nutritional, Food and Consumer Sciences

[2]Hochschule Neubrandenburg – University of Applied Sciences, Department of Agriculture and Food Sciences, Section of Dietetics, Brodaerstraße 2, 17033 Neubrandenburg, Germany

[3]Fachhochschule St. Pölten GmbH – University of Applied Sciences, Department of Health Sciences, Matthias Corvinus-Straße 15, A-3100 St. Pölten, Austria

[4]Hanzehoogeschool Groningen, School of Health care studies, Nutrition and Dietetics Programme, Petrus Driessenstraat 3, NL 9714 CA Groningen The Netherlands

[5]Artesis Plantijn University College Antwerp, Department of Science and Technology, Nutrition and Dietetics Programme, Kronenburgstraat 47, 2000 Antwerp, Belgium

Corresponding author with contact details:

Prof. Dr. Kathrin Kohlenberg-Müller

Hochschule Fulda – University of Applied Sciences, Department of Nutritional, Food and Consumer Sciences

Leipziger Str. 123

D-36037 Fulda

Germany

0049(0)661 9640 378

kathrin.kohlenberg-mueller@oe.hs-fulda.de

Abstract:

Background & aims: Personalized dietary interventions, are based on clear structured, systematic and consistent processes and many dietetic associations worldwide recommend process models to increase quality of care and effectiveness of dietetic consultations. Since behavioral modification is linked to effective dietetic interventions, behavioral-environmental aspects are explicitly mentioned already in nutrition assessment by dietetic associations. The aims of the following report are to investigate the role and importance of components of behavior that influence behavior or behavior change in nutritional assessment, and to illustrate existing tools.

Methods: The present work is part of the EU-funded project IMPECD ("Improvement of Education and Competences in Dietetics", www.impecd.eu). The project aims to improve the clarity and consistency of national dietetic process models to unify education and training of future dietitians. Experts from five European Universities of Applied Sciences (UAS) in Antwerp (BE), Fulda (DE), Groningen (NL), Neubrandenburg (DE) and St. Pölten (AT) developed a Massive Open Online Course (MOOC) consisting of several virtual and interactive clinical cases. It warranted a detailed evaluation of all dietetic care process steps, starting with dietetic assessment.

Results: Although up-to-date definitions for nutrition assessment from professional societies in Clinical Nutrition and Dietetic Associations integrate behavior, it is not clear nor documented what behavioral-environmental aspects are to be assessed by dietetic professionals. Important components of assessing behavior are in particular motivation, health literacy and nutrition literacy competence as well as factors affecting behavior as depression, fatigue, emotional distress and anxiety.

Conclusion: Indisputably, baseline assessment of behavioral-environmental aspects is important to increase the therapeutic efficiency of personalized dietetic interventions. Documentation of baseline behavior characteristics lead to increased visibility of the personalized dietetic intervention. More research on assessing behavioral-environmental aspects in dietetic interventions, especially which components belong to the assessment of behavior and which methods are the best to use, is key to a better health care.

Keywords

dietitians; nutrition assessment; behavioral-environmental aspects; personalized dietetic intervention; process models; tools

Introduction:

Personalized dietetic interventions, used as synonymous to dietary advice, are based on consistent processes. This concept of following and recording a systematic process is described in process models and indicates that the dietetic intervention is clearly structured and continue along a consistent algorithm (1, 2).

All process models are focusing on patient centered care, which is best defined by "providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions" (3)

All dietetic process models use nutrition assessment as first step in the algorithm (4) and dietetic associations consistently recommend to integrate behavioral aspects already in nutrition assessment. According to the British Dietetic Association (BDA) personalized dietetic interventions are designed with "the intent of changing nutrition related behaviors, risk factors, environmental factors or aspects of physical or psychological health or nutrition status" (1). The definition of the BDA implies that the main target of dietetic intervention is the change of eating behavior and related factors. Consequently, great attention has to be paid to behavioral-environmental aspects in the definitions of nutrition assessment and there are important questions arising from this. Therefore, the aims of this opinion paper are:

- to give insight in the role of psychological factors affecting behavior using some special examples
- to underline the big role of psychological factors for dietetic intervention and
- to discuss the consequences for assessing behavior in dietetic interventions

The present opinion paper is authored by the consortium of the EU-sponsored strategic partnership "Improvement of Education and Competences in Dietetics" (IMPECD, www.impecd.eu, Project Agreement Number 2015-1-AT01-KA203-005039 GZ: 235/11/15, duration 1.9.2015 – 30.8.2018). IMPECD collaborates with five European Universities of Applied Sciences (UAS) in Austria, Germany Belgium and the Netherlands. All partnering UAS offer bachelor courses in dietetics and nutrition. The project aims to improve the clarity and consistency of national dietetic process models to unify education and training of future dietitians. An overview of process models in dietetic care used in Europe (5) and the role of outcome evaluation are already published (6) This is all done with having the increased need for evidence-based approaches and cost/outcome efficacy in mind.

Behavioral-environmental Assessment

Nutrition assessment is fundamental for determining dietetic diagnosis as well as planning implementing, and evaluating the outcome of the dietetic intervention. Furthermore, nutrition assessment provides the baseline indicators for monitoring and outcome evaluation. National and international Dietetic Associations (1, 7) and consequently standard textbooks that are widely used in education and training of dietitians (8, 9) uniformly recommend that behavioral-environmental components should be integrated in the nutrition assessment in addition to standard components such as client history, diet history and clinical status (see Table 1 and 2). The reasoning is that additional assessment of behavioral-environmental components will enable dietitians to choose the appropriate coaching model/way of dietetic intervention. Thereby, the access to individual patient will increase and participation barriers will decrease, resulting in expanded motivation and adherence to recommendations (10, 11). All summarized, including behavioral-environmental components should support effective behavioral change and improved health outcome. In addition, evaluating behavioral-environmental aspects at baseline will enable a comparison and use for monitoring and outcome evaluation.

In consequence, all dietitians are challenged to assess also behavioral-environmental aspects as part of nutrition assessment.

Societies for Clinical Nutrition	Definitions and description
The European Society for Clinical Nutrition and Metabolism (ESPEN) (12)	"Nutritional assessment should be performed in all subjects identified as being at risk by nutritional risk screening, and will give the basis for the diagnosis decision, as well as for further actions including nutritional treatment. Predefined assessment tools like Subjective Global Assessment (SGA), Patient-Generated (PG) SGA and Mini Nutritional Assessment (MNA) could be used to facilitate the assessment procedure. Assessment of the nutritional status comprehends information on body weight, body height, body mass index (kg/m2), body composition and biochemical indices. Objectives of the assessment are to evaluate the subject at risk according to the following measures: - A medical history should be taken, and physical examinations and biochemical analyses should be performed in order to decide the underlying disease or condition that may cause the potential state of malnutrition. - Social and psychological history is taken to establish potential effects of living conditions, loneliness and

	depression on nutritional needs, and whether input from other professional groups may be of benefit."
American Society for Parenteral and Enteral Nutrition, ASPEN (2011)(13)	Nutrition assessment is "a comprehensive approach to diagnosing nutrition problems that uses a combination of the following: medical, nutrition, and medication histories; physical examination; anthropometric measurements; and laboratory data."

Table1: Definitions of nutritional assessment published by Societies for Clinical Nuitrition

Dietetic associations	Definitions
AND 2017 (7)	Nutrition Assessment is a systematic approach to collect, classify, and synthesize important and relevant data from clients (where "client" refers to individual and population). This step also includes Reassessment, which additionally includes collection of new data, and comparing and reevaluating data from the previous interaction to the next. Nutrition Assessment is an ongoing, dynamic process that involves initial data collection as well as continual reassessment and analysis of the client's status compared with accepted standards, recommendations, and/or goals.
The British Dietetic Association (2016). Model and Process for Nutrition and Dietetic Practice (1)	Assessment is a systematic process of collecting and interpreting information in order to make decisions about the nature and cause of nutrition related health issues that affect an individual, a group or a population. Assessment is the first step in the nutrition and dietetic process. Its purpose is to obtain adequate and relevant information in order to identify nutrition-related problems and to inform the development and monitoring of the intervention. It is initiated by identification of need, such as screening, referral by a health professional, self-referral, high level public health data, epidemiological data or other similar process.

Table 2: Definitions of nutritional assessment published by Dietetic Associations

Based on the limitations of existing definitions and to highlight behavioral-environmental aspects, IMPECD consortium developed its own definition on nutrition assessment for internal methodological and didactical purposes. The definition aimed at overcoming the limitations of all previous definitions, especially concerning the behavioral-environmental aspects.

IMPECD definition: *Dietetic Assessment is the first step of the Dietetic Care Process. It is a systematic process to gather dietetically adequate and relevant information about the client by using state of the art methods. The aim is to identify nature and cause of dietetic related problems of the client. The gathered information are documented in types of categories (client history, diet history, behavioral-environmental aspects, clinical status) or following the International Classification of Functioning, Disability and Health (ICF)-model.*

Relevance of components of behavior as part of nutrition assessment.

Information on conditions that influence behavior or behavior change are important for the dietitians to select the appropriate counseling technique for applying effective dietetic intervention to achieve behavioral change of the client. Several counselling techniques are available using different concepts stemming from psychology, psychotherapy and health sciences. A list of the most common counseling techniques is shown in table 3. Counseling techniques should be tailored and varied to the individual needs as well as the baseline nutritional knowledge of patients to achieve effective changes in behavior (1, 14).

Often patients have basic nutrition knowledge and are not able to turn theoretical knowledge into daily eating practice (15).

To achieve an effective change in behavior, patients have to be sufficiently motivated (16, 17). Consequently, motivation should be assessed e.g. by using the transtheoretical model TTM (18) or any motivation questionnaire listed in table 2. Thereafter the dietetic intervention can adapted to the individual stage of readiness to change (19). Dietitians in general do know these principles and a recent review confirmed the high relevance of assessing baseline motivation for weight management. (20).

However, a closer look at the literature points out inconsistent effectiveness in daily practice. For example, a prospective cross-sectional study about motivation and weight loss following gastric band surgery, showed no weight loss differences after 2 years between the highest and lowest quartiles of readiness of change at baseline (21). Stewart et al. (22) investigated baseline motivation in patients

with non-alcoholic fatty liver disease and demonstrated no association with weight change after 6 months.

In contrast, promising results do exist as well. Type 2 diabetics of low socio-economic status, who were in the action stage (high readiness to change) had fewer behavioral dietary barriers ($p<0.001$) and higher self-efficacy to diabetes management ($p<0.001$) than diabetics of the same socio-economic status with lower motivation (23). All in all, the relevance of baseline motivation assessment warrants further investigation but it seems to be one of the beneficial aspects under certain conditions.

Depressive symptoms, emotional distress and anxiety are known to negatively impact eating and physical activity. Fatigue complicates behavior change through reduced motivation, reduced physical activity and general lethargy (24). Assessing these behavioral-environmental aspects is very important to modify dietetic intervention to address these conditions. The baseline behavioral assessment increases therapy adherence and thereby improves eating behavior (25, 26). Moreover, baseline behavioral assessment is mandatory for measuring behavioral improvements as outcome indicator, which can be supportive in evaluating the efficiency of dietetic interventions (17, 24–31). To show the big dimension of assessing behavioral-environmental aspects a selection of assessment tools are shown in table 4.

Model	Short description of theory
CBT Cognitive Behavioral Theory (32)	CBT assumes that all behavior is learned and that environmental and internal factors are related to one's behavior. The theory endorses self-monitoring and problem solving, leading to more awareness of internal and external cues and their response.
C-SHIP Cognitive-Social Health Information Processing (33)	This model focuses on the individual's encodings and construals, expectancies, affects, goals and values, self-regulatory competencies, and their interactions with each other as well as the health-relevant information in the course of cognitive-affective processing.
COM-B system capability, opportunity, and motivation (34)	The COM-B sytem is a model of behavior change: behavior (B) occurs as the result of interaction between three necessary conditions, capabilities (C), opportunities (O) and motivation (M).
NLP Neurolinguistic programming (35)	NLP is a communication framework using techniques to understand and facilitate change in thinking and behavior to achieve specific goals in life. According NLP there is a connection between neurological processes (neuro-), language (linguistic) and behavioral patterns learned through experience (programming).

TTM Transtheoretical Model (18)	The TTM was developed and introduced to understand behavior change, especially associated with addictive behavior. According TTM change involves progress through six stages: precontemplation, contemplation, preparation, action, maintenance, and termination.
MI Motivational Interviewing (36, 37)	MI is a directive person-centered approach designed to explore ambivalence and activate motivation for change. A key component is to acknowledge that clients are entitled to make no change. MI invites people to consider their own situation and find their own solution.
TPB Theory of Planned Behavior (38)	The TPB predicts and explains human behavior in specific contexts. Behavior is influenced by intentions to perform that behavior. In turn, these intentions are preceded by attitude, social norm and self-efficacy with regard to the desired behavior.
Bandura´s social learning theory (16)	Behavior and behavioral change depend on both outcome expectations and personal efficacy expectations. The self-efficacy expectations can vary along three dimensions: magnitude, generality and strength.
ASE-model Attitude, Social Norm, Self-Efficacy model (39)	The ASE-model (also called "I changed model) integrates ideas of Ajzen's Theory of Planned Behavior (TPB) and the Bandura´s social learning theory to explain behavioral intentions.
ACT Acceptance and Commitment Therapy (40, 41)	According to ACT, psychological problems develop due to inappropriate or unhelpful regulation of behavior through language processes leading to psychological inflexibility in relation to environmental contingencies. ACT aims to reduce the extent to which beliefs and other symptoms dominate conscious experience and behavior.
PAPM Precaution Adoption Process model (42)	The PAPM consists of seven distinct states between ignorance and completed preventive action. The stages are "unaware of the issue", "aware of the issue but not personally engaged", "engaged and deciding what to do", "planning to act but not yet having acted", "having decided not to act", "acting" and "maintenance".
5As model Assess, Advise, Agree, assist, arrange (43)	The '5As' model of behavior change provides a sequence of evidence-based clinician and office practice behaviors (Assess, Advise, Agree, Assist and Arrange) that can be applied in primary care settings to address a broad range of behaviors and health conditions.
GROW-model (44)	The GROW model (or process) is a linear method for goal setting and problem solving. **G** Goal setting for the session (short and long term) **R** Reality checking to explore the current situation **O** Options and alternative strategies, or course of actions **W** What is to be done, when and by whom and the will to do it

Table 3: Important counseling techniques to assess behavioral-environmental aspects in nutrition assessment

Several psychological factors can have an negative impact on the outcome of the dietetic intervention. Therefore, important components of assessing behavior are also factors affecting behavior as depression, fatigue, emotional distress and anxiety.

Nutrition literacy

„Nutrition literacy is knowledge of nutrition principles and skill in food-related tasks“ (45). Dietetic interventions are pointless if the patient does not understand the instructions of a dietitian (15). Nutrition literacy tests can check the ability, not only to read and write, but also to process dietary information (46, 47). Knowing the level of nutrition literacy of clients enable dietitians to tailor information in formats patients understand (48). Nutrition literacy questionnaires can detect both, nutrition knowledge and nutrition skills. Consequently, using literacy questionnaires during assessment can assist the dietitian to choose appropriate communication models (49, 50). Gibbs and colleagues (15) shows that the Nutrition Literacy Assessment Instrument (NLAI) can better assess low levels in nutrition literacy compared to dietitian practitioner self impression. In 44% of the cases, dietitians estimate educational status of patients incorrectly, but the NLAI could detect 90% of deficient knowledge, which illustrates the advantage of the tool. Two systematic reviews (29, 51) showed positive associations between nutrition knowledge and diet quality and demonstrated that nutrition literacy is strongly linked to all major lifestyle diseases. They additionally stressed the use of high-quality validated nutrition literacy questionnaires as listed in table 4 (29, 51).

Factors influencing behavior and the capacity for behavioral changes:

Behavior is influenced not only by nutrion literacy but also by several other factors as depression, fatigue, emotional distress and anxiety and these are important components to be assessed. parameter.

Depressive symptoms

Wang and colleagues (25) evaluated dietary change in about 3000 breast cancer survivors and showed baseline depressive symptoms to cause lowered completion of dietary recalls and visits in the control group. Successful behavioral activation in the intervention group counteracted the impact of depressive symptoms. Further trials confirmed the association between depressive symptoms and dietary intake mainly in obese patients, in which depressive disorders are prevalent (52, 53). Appelhans et al. (52) used the Beck Depression Inventory (BDI-II) (see table 4) and showed that more severe depression associates with poorer diet quality in obese patients. Somerset et al. (53) investigated adherence to a 10-week weight loss intervention in 64 overall healthy participants without diagnosed depression and BMI > 27 kg/m². The results showed that depression symptoms analyzed by Beck Depression Inventory (BDI-II) negatively correlates to the duration of participation ($r = 0,38$, $p < 0,05$). In summary, depressive symptoms – even in the absence of a medical diagnosis of depression - can

affect eating behavior, readiness to change and predict poor weight loss outcome. In populations with high prevalence of undiagnosed depressogenic tendency assessing depressive symptoms at baseline and addressing them appropriately during dietetic intervention might be effective to improve adherence and dietetic intervention outcome.

Emotional distress and anxiety

Also emotional distress and anxiety may interfere with the outcome of dietetic intervention. For example, emotional distress measured with Problem Areas In Diabetes (PAID) (see table 4) Scale at baseline associates with lesser adherence to diet recommendations in type 2 diabetes (26, 28). In case of emotional stress at baseline, the authors recommend addressing patients' sense of worry and guilt, uncertain acceptance of diabetes diagnosis and unclear treatment goals during dietetic intervention. Reduction of baseline emotional distress and anxiety may also serve as an outcome indicator in dietetic intervention, for example in patients with eating disorders where high levels of residual anxiety after intervention may indicate higher risk of relapse. Sala et al. (54) examined anxiety traits using the State Trait Anxiety Inventory (STAI-Y) at baseline in 75 women with longstanding eating disorders and showed significant improvements of anxiety with weight gain although anxiety scores remained higher than normal. Another study indicated associations between unhealthy diet coping strategies and anxiety (STAI-Y) (see table 4) or stress (perceived stress scale – PSS) in women with gestational diabetes (55). The authors suggest concomitant stress reduction programs to increase diet adherence. Another case-control study on cardiovascular events underline the role of anxiety and depressive symptoms. Only participants with low levels of anxiety remain higher adherence to the Mediterranean diet which has a significant protective factor (30). In total 1000 Greek persons were evaluated, half of them having had a first event of acute coronary syndrome or stroke in the past (30). Therefore, the authors recommend to evaluate anxiety and depressive symptoms at baseline in the primary cardiovascular prevention of apparently healthy individuals and dietetic intervention should be provided combined with psychological treatment for synergistic effects (30).

Fatigue

Many diseases cause secondary conditions which impact dietary intake, for example diagnosed or undiagnosed fatigue (56). Artom et al. (24) confirmed the relevance of undiagnosed fatigue for dietetic interventions in patients with advanced kidney disease. The etiology of fatigue is complex and involves e.g. chronic inflammation, depression and anxiety, sleep and malnutrition. Measures against fatigue can also be part of dietetic intervention, e.g. increasing physical activity of the client (57, 58) or

increasing intake of anti-inflammatory nutrients. Another interesting trial points out that approximately 50% of patients with diagnosed chronic fatigue syndrome have food intolerances (59).

Discussion

Nutrition assessment is fundamental in process driven personalized dietetic intervention and it seems obvious that assessing nutrition related behavioral-environmental aspects should be a great integrated part of this. However, as we detailed above, assessment of behavioral-environmental aspects in personalized dietetic intervention is less than clear, although it is shown to be relevant and meaningful.

As exemplified in this paper the evidence that taking into account the behavioral-environmental factors will alter the outcome of personalized dietetic intervention is limited, particularly by the quality of published studies. On the single study level, the study designs of the dietetic interventions are often inconsistently defined, information on the assessment of behavioral-environmental aspects are not available and studies vary greatly in duration and number of consultations. Therefore, meta-analyses summarize different kinds and qualities of dietetic intervention and that might contribute to the unsatisfying results. Even highly regarded Cochrane reviews do not provide minimal requirements to define dietetic interventions including the assessment of behavioral-environmental aspects. For example , the Cochrane review of Rees et al. (60) included all studies in which “dietary advice” comprised either verbal or written, single or multiple contacts with individuals or groups, and may be delivered by health professionals or other agencies such as fitness consultants, trade unions or commercial organizations.

Despite the poor results for dietetic interventions, there is consistent evidence that successful change to more healthy diets improves health and reduces the risks for nutrition related diseases. A recent landmark paper in New England Journal of Medicine (61) associates changes in diet quality implemented between 1986-1998 with mortality during the succeeding 12 years (1998-2010) in about 75000 US adults. A 20-percentile increase in diet quality is significantly associated with an 8-17 % reduction in total mortality and a 7-15% risk reduction of cardiovascular death. However, the study did not account for relevant behavioral-environmental factors. Sustained improvement of diet behavior is only the second step. To reach this step, individuals must succeed in modifying their dietary behavior. Dietetic intervention based on a detailed assessment of behavioral-environmental aspects is destined to enable and facilitate dietary modification.

Perri and colleagues (62) demonstrated that extended behavioral programs for enhancing self-management in obese women are associated with better outcomes compared to standard behavior therapies or education-only interventions. There is evidence that in some settings coaching models

might be more effective than drugs. Venditti et al. (10) investigated coaching approaches for weight loss and physical activity adherence. In total, 3234 subjects were recruited and randomly assigned to an intensive lifestyle, metformin, or placebo arm and followed for an average 3.2 years. The lifestyle group learned self-regulatory skills for goal-setting, self-monitoring of food intake, activity and body weight, managing environmental cues, energy balance, and problem-solving. In result, the lifestyle intervention was more efficacious than drug or placebo treatment in delaying diabetes onset. These results underline the importance of assessing behavioral-environmental factors in intervention programs.

The AND Workgroup on Nutrition Counseling performed a systematic review (32) to evaluate the evidence on behavior change strategies used in dietetic intervention. The combination use of behavioral change theory and cognitive behavioral theory have strong evidence to support the modification of dietary habits, body weight and cardiovascular/diabetes risk factors. On the other hand the review also showed that for many theories no convincing evidence exists (32). Further well designed randomized controlled trials are needed to validate the effectiveness of the different models in dietetic interventions and to clarify which method should be used for the assessment of behavior.

In summary, the IMPECD consortium underline the big role of psychological factors and nutrition literay for dietetic intervention. For further research and also in practice it is important to better characterize the patient by assessing behavioral-environmental factors and thereby gain information on the optimal communication model to use during dietary advice.

Beside dietitians also regulatory agencies and third-party payer, for example insurance companies are focused on outcomes. Outcome evaluation of dietetic intervention can be complicated because many outside factors may influence health outcomes (7). When health outcomes are not as expected or desired, health care administrators are tasked with determining potential causes. Outcomes can be impacted by something done by the particular health care provider or by HOW the care is provided. Adding behavioral-environmental aspects to nutrition assessment can not only assist to choose the optimal counseling model, it is also important to document baseline behavioral-environmental characteristics, which can serve as outcome indicators to prove the efficiency of dietetic interventions. Therefore, a broader selection of outcome indicators is available. However, the evidence has to be shown in future studies.

Up to now, the implementation of behavioral-environmental assessment is insufficiently considered and described in definitions and textbooks, even though benefits and positive health effects of the application of these tools are confirmed by numerous trials. Transparency is needed for which tools are mandatory and which are facultative. Our analysis showed that instructions on assessing behavioral-environmental aspects during nutrition assessment is still very limited.

The tools for nutrition assessment were largely developed by researchers in clinical nutrition and have many advantages for dietetic intervention. However, and in contrast to clinical nutrition, behavioral-environmental aspects are pivotal in dietetic intervention. An adequate consideration of the behavioral-environmental aspects might contribute to better study results. A high number of tools are available but the appropriateness for the use of the methods in dietetic interventions is not shown. Further development of assessing behavior including defining the tools, validate and verify them for the dietetic use as well as education and training of dietician is necessary to improve the dietetic interventions verifiable. This is a new research field.

Taking into account that personalized dietetic interventions are designed with the intend of changing nutrition related behavior and do to the shown importance of behavioral-environmental aspects further development of the assessment category behavior-environmental is necessary. The definitions of nutrition assessment, especially the definition of the IMPECD consortium presented here, contains a dedication, a central statement, aim and principles as well as the operationalization. There is a great clearness on the kind of information needed for client history, diet history and clinical status. However, it is not clear nor documented what behavioral-environmental aspects are to be assessed by dietetic professionals.

Therefore, the next step should be to determine which components belong to the assessment of behavior and which methods are the best to use. According to our search of literature important components of assessing behavior are eating behavior, motivation, nutrition literacy and health literacy competence as well as factors affecting behavior as depression, fatigue, emotional distress and anxiety. But, unfortunately table 4 is incomplete.

Conclusion:

In summary, our report shows that inclusion of behavioral-environmental aspects is of high importance in nutrition assessment during evidence-based, process-driven dietetic intervention to decrease attrition, provide new outcome indicators and to tailor the coaching model to the individual needs of the patient. To implement adequate communication strategies, psychological and social information received during dietetic assessment is indispensable.

Due to the steadily increasing cost pressure, effectiveness and efficiency of dietetic interventions to achieve positive health outcomes are increasingly important for health care systems in Europe. Failing or missing effectiveness is not only detrimental for health care systems and patients but will also weaken the standing of registered dietitians in the professional world in long term.